PIPE COUPLING COMPRISING A DIVIDED SLEEVE

The present invention relates to pipe couplings for connecting together pipes in a fluid-tight manner.

In our earlier patent specification GB-A-2249366 we describe a pipe coupling for connecting together the ends of two plain-ended pipes in a fluid-tight manner, comprising a tubular steel casing, a tubular rubber sealing sleeve and tensioning means in the form of screw bolts for tightening the casing around the sealing sleeve. The casing has circumferential flanges projecting inwardly from its axial end. Gripping devices in the form of incomplete frustoconical rings of steel sheet are located within the casing at opposite ends of the casing. The outer edges of the gripping rings engage in the angle between the axial wall of the casing and the flanges. The inner edges of the gripping rings are formed with teeth. When the coupling is placed around the ends of two pipes to be connected and the tensioning bolts are tightened, the casing is tightened around the sealing sleeve and the gripping rings, pressing the sealing sleeve against the outer surfaces of the pipe end to form fluid-tight seals and forcing the teeth on the gripping rings to bite into the surface of the pipes to grip the pipe.

The casing is made from a strip of rolled steel formed into a tubular shape with a longitudinal gap between the free ends of the strip. The free ends of the strip are folded back on themselves and welded to form loops along opposite edges of the longitudinal gap. Pins are inserted into the loops. The tensioning bolts pass through transverse holes in

one of the pins and engage in tapped transverse holes in the other of the pins so as to interconnect the two free ends of the casing. Slots are cut in the loops in the region of the transverse holes to provide clearance for the bolts to pass through. When the screw bolts are turned the transverse pins are drawn towards each other, thus tightening the casing around the pipe ends.

The coupling of GB-A-2249366 has been successful in many fields of applications. It has been found however that there can be problems in manufacturing such a pipe coupling for use with pipes of small sizes, say less than 38mm diameter. The tensioning arrangement is too bulky for pipe couplings of this size and the coupling is impractical in many small pipe applications on account of the size of the coupling in relation to the space available in the application, the weight of the coupling, and, especially, the cost of the coupling.

There is a need for a coupling having a tensioning arrangement of a size which is reasonable in proportion to the dimensions of the pipe. The design of the coupling should be such that it can be made lighter than the existing coupling and without pins or welded ends which would make the coupling prohibitively expensive to manufacture for most applications. At the same time the coupling must meet all the performance requirements of resisting internal pressure in the pipeline (typically up to 100 bar), withstanding vibration, axial loads, and shock without leaking, as well as being adjustable

to accommodate variations in the diameters of the pipes to be joined within manufacturing tolerances. The coupling should not deform under pressure. It should be capable of repeated installation and dismantling without deformation and deterioration in performance.

The specification DE-A-3445807 proposes a coupling using a single screw bolt and nut which pass through and interconnect flanges on a tubular casing to tighten the casing. When subjected to tightening, and hydrostatic and axial loads of the kind which would be required for the applications contemplated by the present invention, the casing will to deform.

According to the present invention there is provided a pipe coupling for connecting together the ends of two pipes, comprising a tubular casing, a tubular sealing sleeve inside the casing, and tensioning means for tightening the casing around the sealing sleeve, the arrangement being such that when the coupling is placed around the ends of two pipes to be connected and the tensioning means are tightened the casing presses the sealing sleeve against the pipe ends to form seals, the casing comprising a strip of metal formed into a tube with a gap extending longitudinally of the casing between the free ends of the strip, the tensioning means interconnecting the free ends of the strip, characterised in that the free ends of the strip are bent outwardly to form radially projecting flanges extending longitudinally of the casing on opposite sides of the gap, the two flanges being placed

between two reinforcing members, the tensioning means passing through sets of aligned holes in the reinforcing members and the flanges, the reinforcing member having an angled cross-section and extending substantially the length of the coupling.

The reinforcing members transmit the forces from the tensioning means to the flanges of the casing. The angled cross section of the reinforcing member ensures that the members have resistance to bending and the load is spread across the length of the flanges.

With this arrangement the casing of the coupling can be formed without welding.

In the preferred embodiment, the casing has circumferentially extending end flanges projecting inwardly from the axial ends of the casing. When the coupling is fastened, the reinforcing members also prevent these circumferentially extending end flanges lifting away from the pipe and distorting under the effects of hydrostatic pressure in the pipeline or axial load on the pipes. The reinforcing member having an angled cross-section resists bending when the tensioning means are tightened. Preferably each reinforcing member has a web portion through which the holes for the tensioning means pass, and a flange running along the longitudinal edge of the web portion that is nearer to the axis of the coupling, the flange bearing against the tubular portion of the casing.

In the preferred embodiment of the invention the reinforcing member has a channel-shaped cross section with flanges running along both longitudinal edges of the web portion.

The coupling may be used on pipelines where no axial restraint is required in which case there is no provision for axially locking the coupling to the pipes. However, in the preferred embodiment of the invention, frustoconical gripping rings are located within the casing at opposite ends of the casing, the inner edges of the gripping rings being formed with teeth. When the coupling is placed around the ends of the two pipes to be connected and the tensioning means are tightened the casing forces the teeth on the gripping rings into the surface of the pipes to grip the pipe, and provide axial locking of the coupling to the pipe.

In the preferred embodiment there are two sets of aligned holes and the tensioning means comprise two screw bolts and nuts. Preferably the nuts are of a size that fits between the sides of the U-shaped member so as to prevent rotation of the nuts.

A backing ring may be provided inside the casing adjacent each gripping ring between the gripping ring and the gasket to prevent the gasket bulging between the teeth of the gripping ring.

An inner sleeve may be provided inside the sealing gasket to prevent the gasket bulging inwardly

between the pipe ends.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, of which:-

Fig. 1 shows an exploded perspective view of a coupling in accordance with the invention;

Fig. 2 shows a side view, partly in section through the coupling of Fig. 1; and

Fig. 3 shows an end view of the coupling of Fig. 1.

A pipe coupling 11 comprises a tubular casing 12 and a sealing gasket 13. The casing 12 is formed from a strip of rolled steel into a cylindrical shape, with a longitudinal gap 14. The free ends of the strip which forms the casing are bent outwardly to form radially projecting flanges 15 along opposite edges of the longitudinal gap 14. The outer ends of the flanges 15 are bent back at right angles to form stiffening flanges 16 along the longitudinal outer edges of the flanges 15.

The axial ends of the casing 12 are bent inwardly at right angles to form circumferentially extending end flanges 17.

A bridging member 18 is formed from rolled steel into a part-cylindrical shape with a radius of curvature similar to that of the casing 12. The bridging member fits inside the casing and, in use

is placed with its longitudinal edges beneath the edges of the casing that border the longitudinal gap so as to span the longitudinal gap.

Two reinforcing members 20 are formed of steel with edges bent up to form a channel of U-shaped cross section. The flanges 21 which form the sides of the channel are rounded at 22 at the ends of the member.

Two tensioning screw bolts 25 pass through two sets of aligned holes 30, 31, 32 and 33 in the web portions 23 of the reinforcing plates 20 and the flanges 15. The holes 31 and 32 in the radial flanges 15 are elongated in the radial direction. A hexagonal nut 34 is threaded onto the end of each screw bolt. The dimension across flats of the nuts 34 is slightly less than the internal dimension of the channel between the flanges 21 of the reinforcing member, so that the nuts fit into the channel but are prevented from turning. The heads 35 of the bolts have a hexagonal recess 36 to take a turning tool in the form of an Allen key.

The sealing gasket 13 is of rubber formed into a cylindrical tube. The outer surface 41 of the gasket is smooth and straight. The middle portion 42 of the inner surface of the gasket is also smooth and straight. Near each end of the gasket the inner surface is stepped inwardly to form a sealing lip 43. The gasket 13 fits inside the casing 12.

An inner sleeve 45 is formed from a strip of rolled

steel into a cylindrical shape, with its free ends overlapping. The inner sleeve fits inside the smooth middle portion of the gasket 13.

The sealing gasket has frustoconical end surfaces 44. The slope of each end surface is such that the inner end is nearer the axial middle of the gasket than the outer end.

Two gripping devices are each in the form of a frustoconical ring 50. The ring 50 is made of hard steel and is an incomplete ring having a gap 51. The inner edge 54 of the ring 50 is cut out at intervals to form teeth 52,. When the coupling is assembled the gripping rings fit inside the casing with the outer edge 53 of the ring sitting in the angle formed by the flange 17 and the cylindrical web portion of the casing.

Two backing rings 55 are each in the form of a frustoconical ring,. The rings 50 are made of hard steel and the ends of the ring overlap in the manner of a spiral. The inner edges of the rings 55 are smooth,. The radial thickness dimension of the rings 55 is less than the radial thickness dimension of the rings 50, so that in the assembled condition, the teeth 52 project inwardly beyond the inner edges of the rings 55.

The coupling is assembled as follows. The inner sleeve 45 is inserted into the gasket 13, the resilience of the steel allowing the sleeve to be compressed so that it can be inserted past the

sealing lips 43.

The bridging member is place in the casing and the sealing gasket is inserted into the casing, the resilience of the steel allowing the casing to be opened up sufficiently for the gasket to be inserted past the end flanges 17. The bridging member is positioned to span the longitudinal gap 14.

The backing rings 55 are inserted into the ends of the casing to abut the frustoconical end surfaces of the gasket. The resilience of the steel allows the rings to be compressed so that they can pass the end flanges 17.

The gripping rings 50 are inserted into the ends of the casing to abut the backing rings. Again the resilience of the steel allows the rings to be compressed to pass the end flanges.

The reinforcing members are placed on opposite sides of the radial flanges 15 and the tensioning bolts are inserted through the holes 30, 31, 32 and 33 in the members and flanges and threaded into the nuts 34. The coupling now forms a sub-assembly ready for fitting in a pipeline.

In use, the ends of two plain ended pipes 60 are inserted into the coupling from opposite ends as shown in Fig. 2. A space may be left between the pipe ends to allow for angular deflection, or to avoid abrasive wear, or to dampen vibration. With the coupling in place, the screw bolts 25 are

tightened to clamp the coupling to the pipes. As the bolts 25 are tightened, the radial flanges 15 of the casing 12 are drawn together, thereby applying a radially compressive force to the casing. The bridging member 18 is arranged so as to span the longitudinal gap 14 in the casing 12. In this way the bridging member supports the gasket in the region of the gap 15 where there is no support from the casing.

The tightening of the tensioning bolts 25 presses the annular sealing lips 43 into sealing contact with the outer surfaces of the pipe ends 60. At the same time, the outer edge of the gripping ring 50 engages in the angle between the end flange and the web portion of the casing causing the gripping ring to be is pushed inwardly. The compression of the gripping ring causes the teeth 42 to bite into the surface of the pipe, thereby providing locking of the coupling to the pipe against axial movement.

The backing ring provides lateral support for the gasket and prevents the gasket bulging out through the gaps between the teeth 42.

The inner sleeve 45 overlaps the ends of the pipes 60 and prevents the gasket from bulging into the space between the pipe ends, which may occur particularly if pressure in the pipeline is below that outside.

The coupling is adjustable and one size of coupling is suitable for use with pipes of sizes that vary

within the tolerance range of manufacture. It can be dismantled and reassembled without loss of effectiveness. The adjustable nature of the coupling makes one size of coupling suitable for use with pipes of different materials but the same nominal diameter.

In couplings which have flanges, there is a tendency for the casing to flatten on the side of the coupling when the tensioning means are tightened. We have found that this effect is reduced if the channel-shaped reinforcing members described above are used.

A coupling without the reinforcing members was found to distort and burst at internal pressures of 40 bar. With the reinforcing members, a coupling has been found to perform up to 100 bars pressure.